Pixel template + LA calibration

- alignment/calibration
- validation

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Tracker Alignment Meeting

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Introduction

- Generic hit reconstruction previously used in LA calibration with Millepede.
- New code for pixel templates provided by pixel group:

  `[cvs co –r ls1_current RecoLocalTracker/SiPixelRecHits]`

- Allows to use standalone LA correction in template hit reconstruction.
- Should improve precision of alignment/calibration compared to generic hit reconstruction.
- Correct LA treatment must be enabled (disabled by default):

```
DoLorentz = cms.bool(True) in

RecoLocalTracker/SiPixelRecHits/python/PixelCPETemplateReco_cfi.py
```

Alignment setup: mp1296

Alignment starting from CRAFT12 , GT: FT_R_53_V21

Data used in alignment (no weights applied):

- MinimumBias | A+B+C+D
- SingleMuon | A+B+C+D
- ZtoMuMu | A+B+C+D
- Cosmics interfill | A+B+C+D
- Cosmics CRAFT12 | A
- Cosmics CRUZET | A (10 GeV P estim.)
- Cosmics 0T | C (10 GeV P estim.)
- 0T Collision | C (3 GeV P estim.)

No Kinks&Bows

Number of used tracks: ~60 M

Alignables: large structures, all modules: 111111

Calibration setup: mp1296

Generic hit reconstruction

```
connect = 'frontier://FrontierProd/CMS_COND_31X_PIXEL',
  toGet = cms.VPSet(
    cms.PSet(
      record = cms.string('SiPixelLorentzAngleRcd'),
      tag = cms.string('SiPixelLorentzAngle_v03_offline')
      )
    )
```

Pixel LA payload

<u>LA calibration setup:</u>

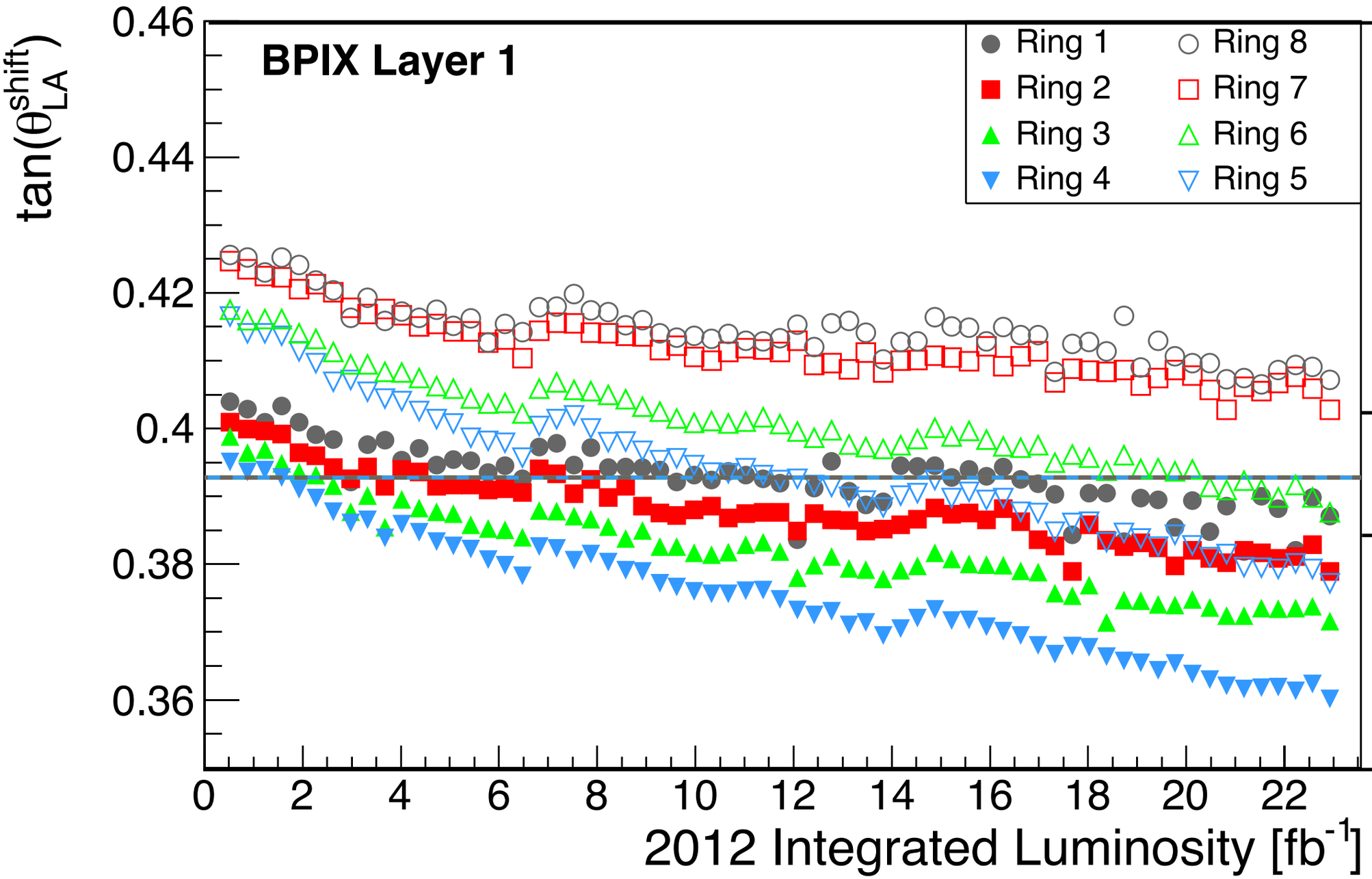
- BPIX granularity:
  24 parameters: 3 layers x 8 rings
- FPIX granularity:
  2 parameters: left side, right side
- TIB granularity:
  24 parameters: (4 layers x 6 rings) x 2 [strip/deco]
- TOB granularity:
  36 parameters (6 layers x 6 rings) x 2 [strip/deco]
- Time granularity:
  Pixel: 65 IOVs
  Strip: 20 IOVs

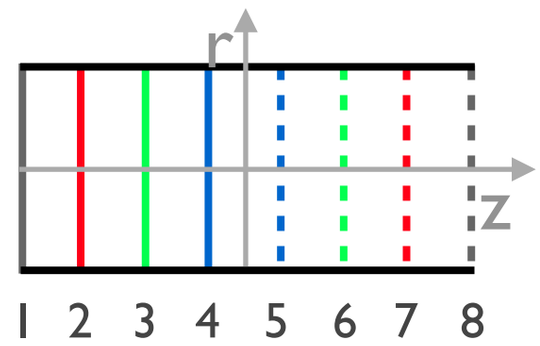
Alignment setup: mp1312

Identical to mp1296, except:

- CMSSW release modified with patch from Pixel group
- Using template hit reconstruction
- Pixel template from GT (8 IOVs)

LA evolution: BPIX: mp1296 (Layer 1)



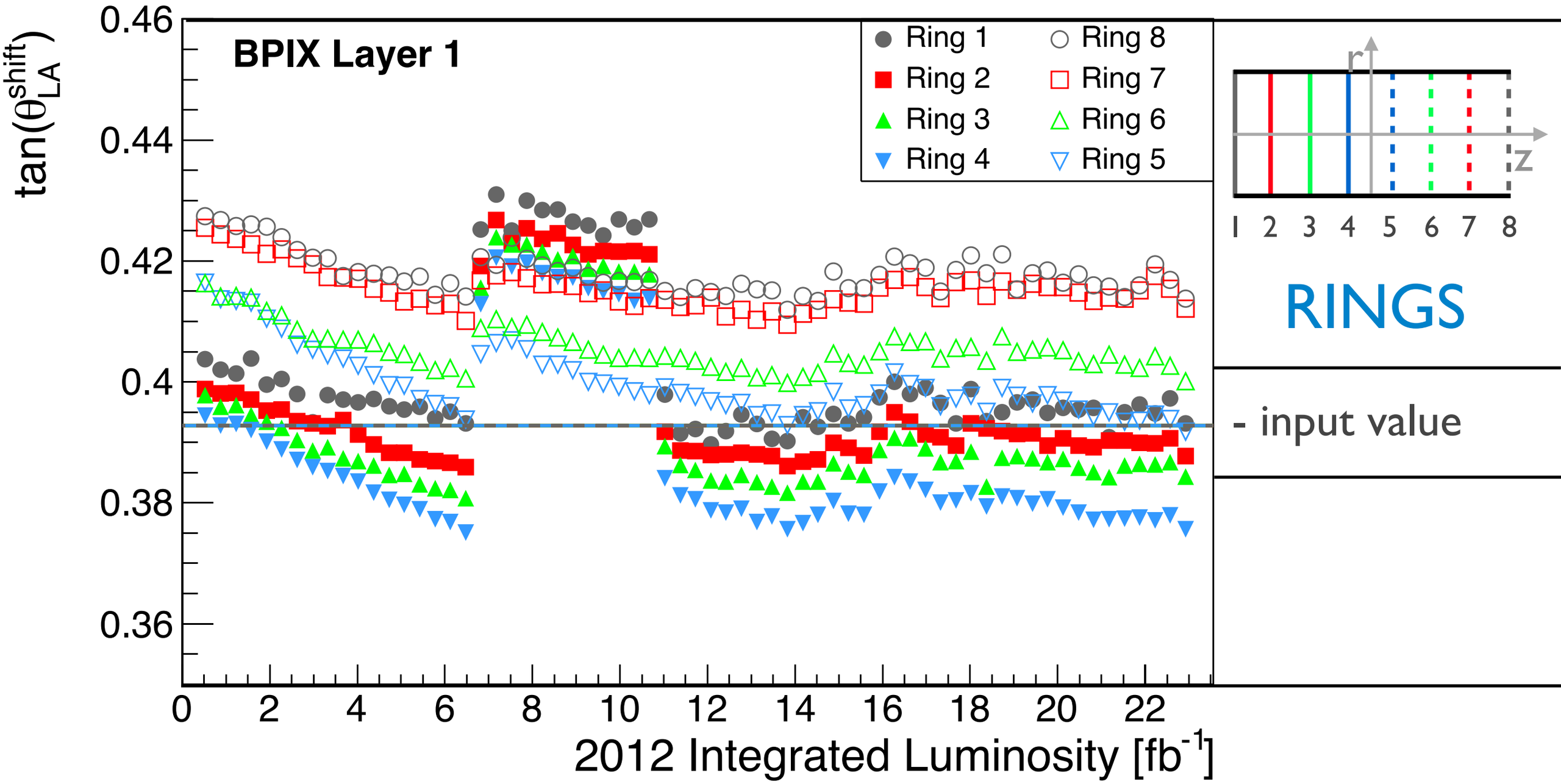


RINGS

- input value

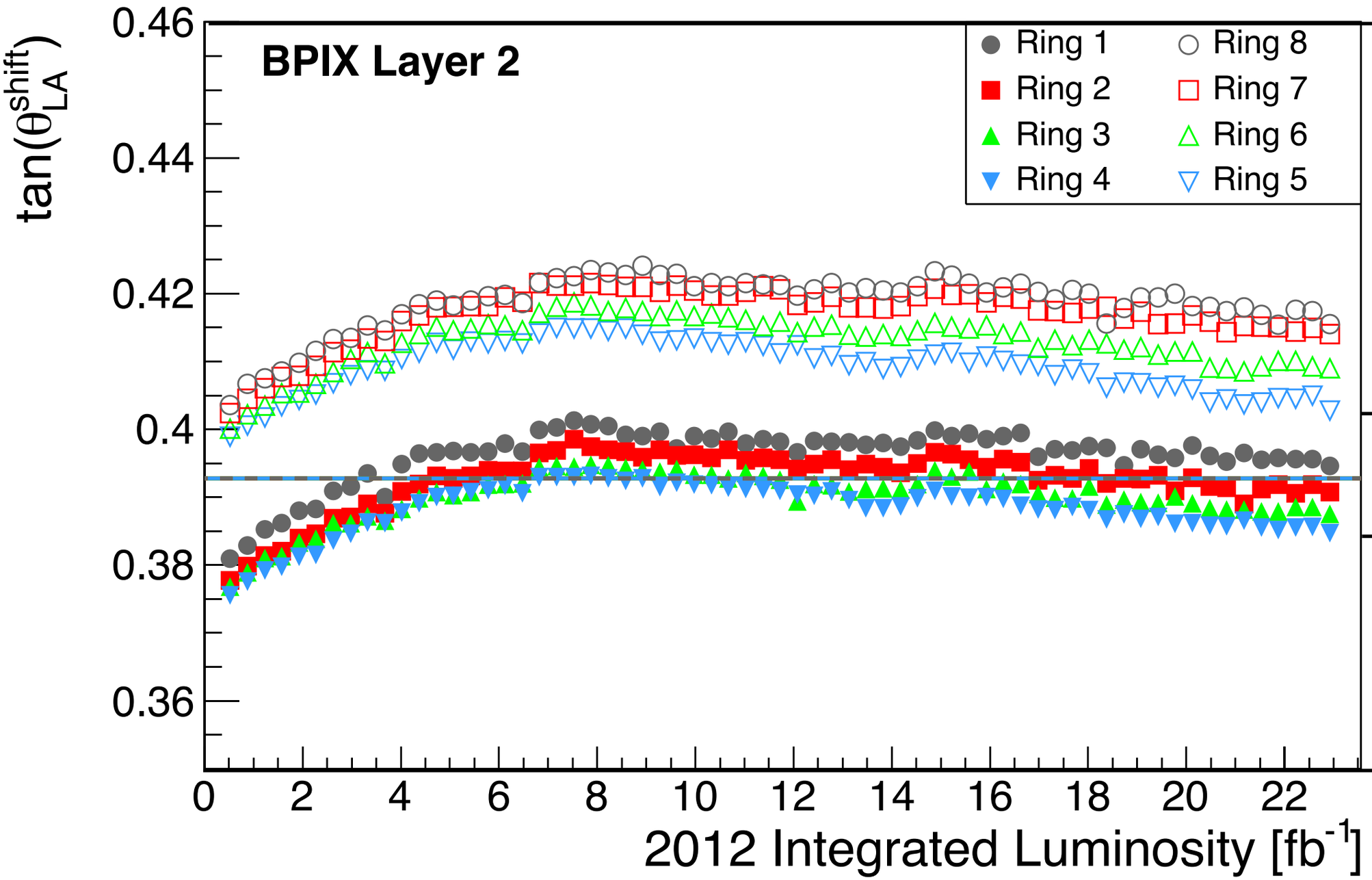
- Consistent development in all rings.
- Smooth evolution due to fixed module alignment.

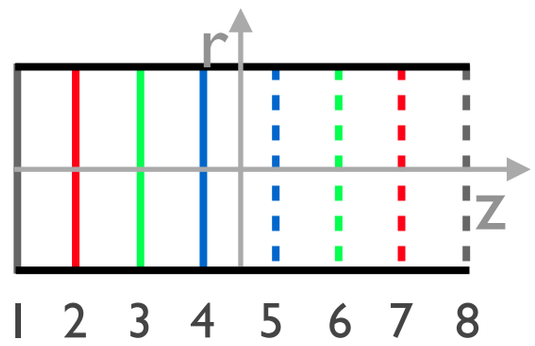
LA evolution: BPIX: mp1312 (Layer 1)



- Jumps due to time dependent Pixel template

LA evolution: BPIX: mp1296 (Layer 2)

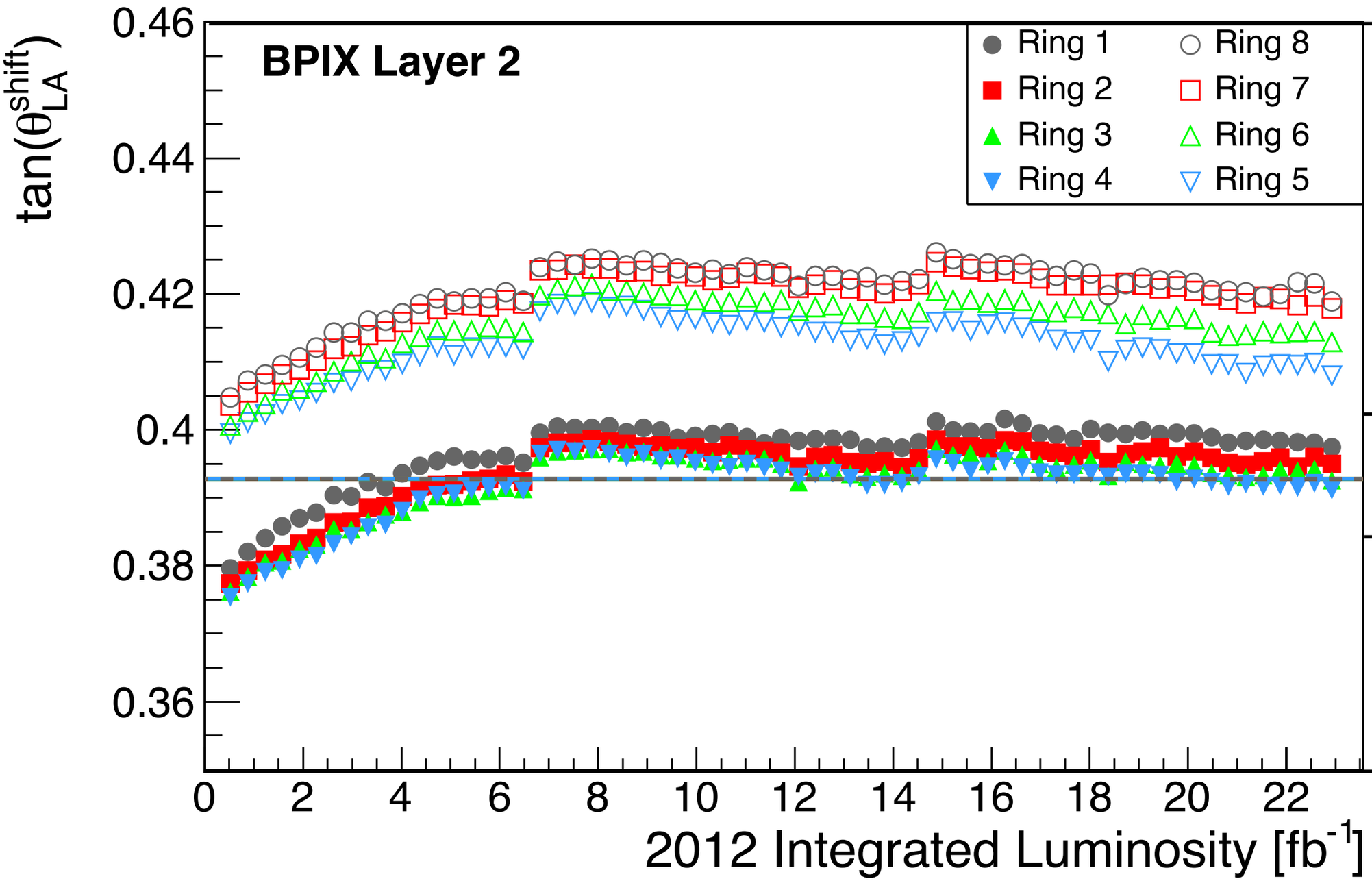


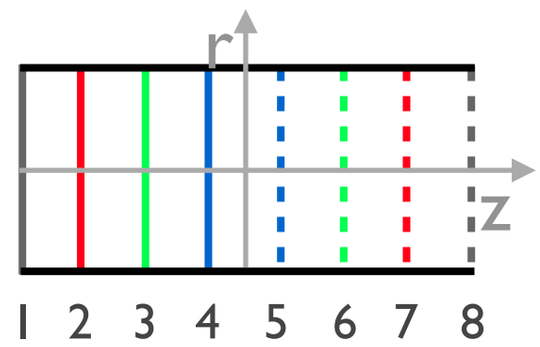


RINGS

- input value

LA evolution: BPIX: mp1312 (Layer 2)



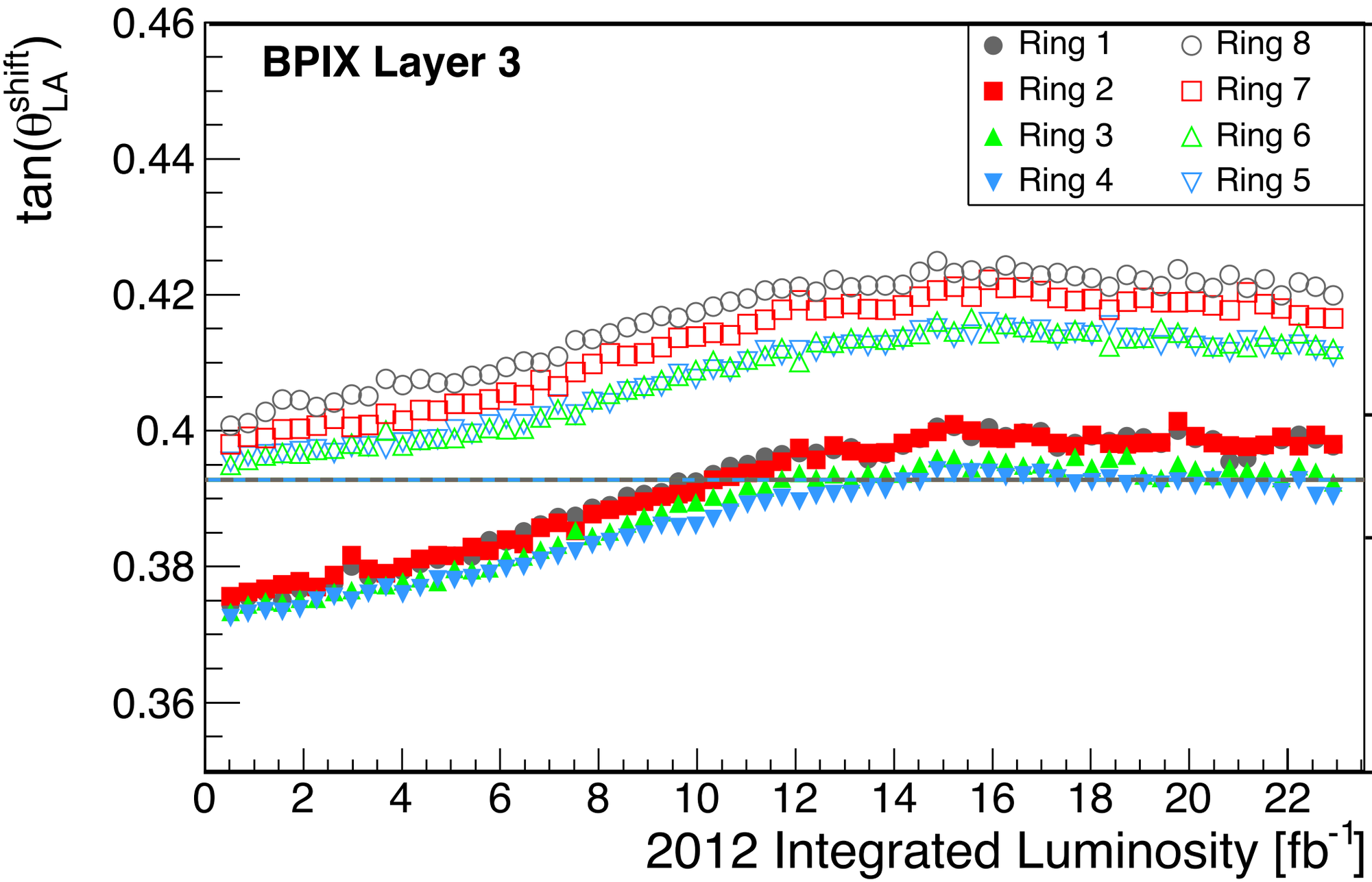


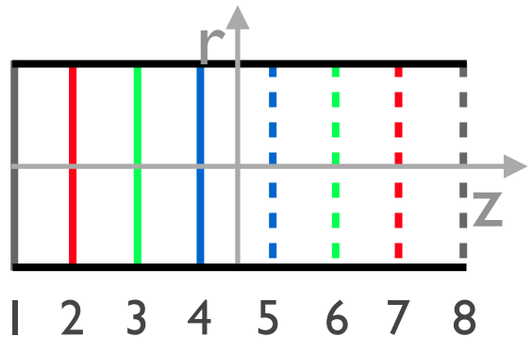
RINGS

- input value

- Closer absolute values.

LA evolution: BPIX: mp1296 (Layer 3)

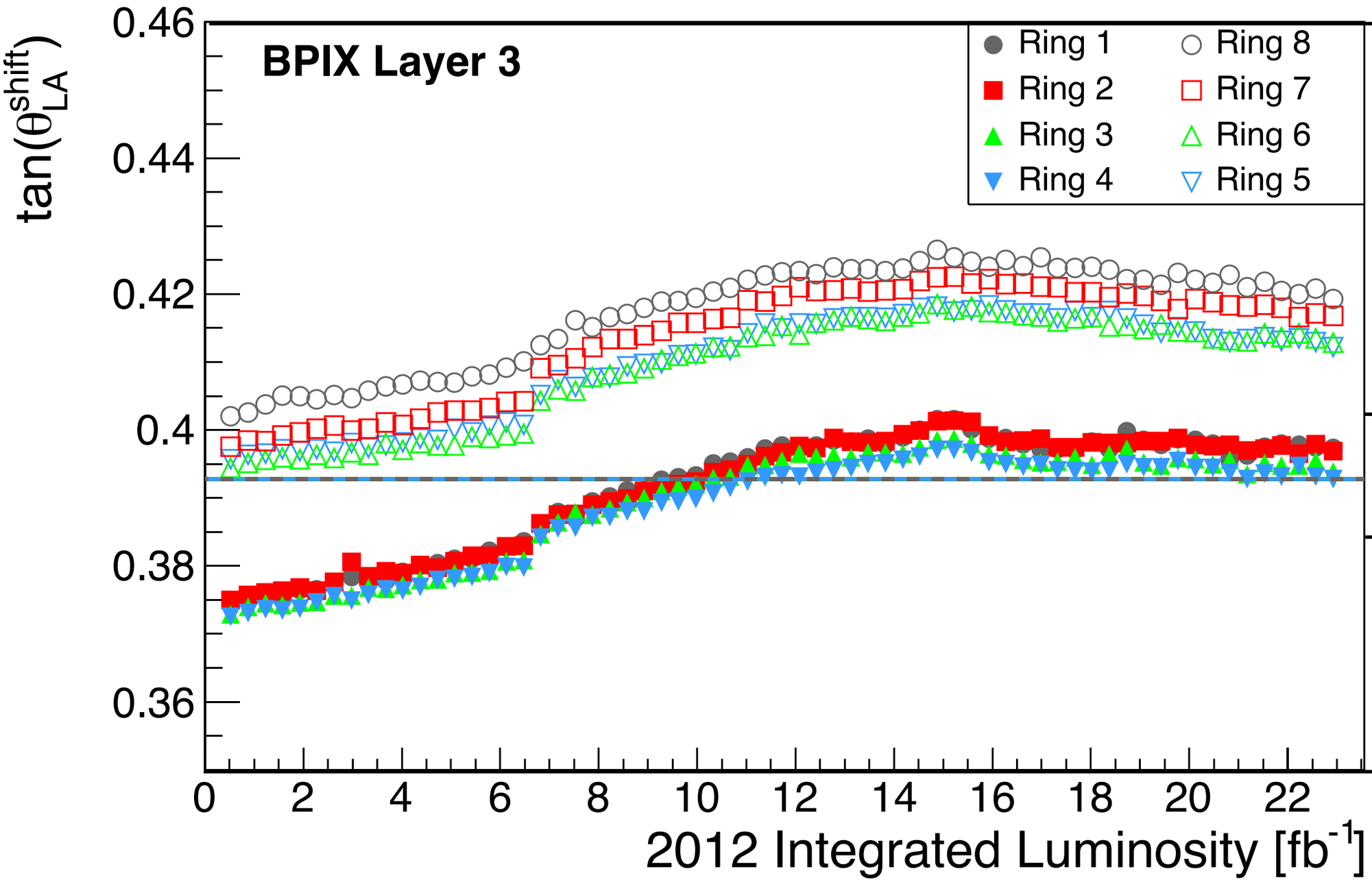


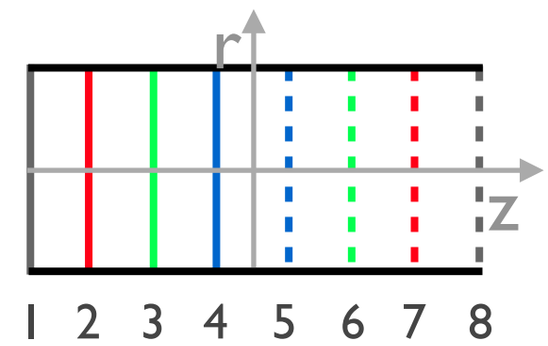


RINGS

- input value

LA evolution: BPIX: mp1312 (Layer 3)





RINGS

- input value

Validation setup

mp1296 (Generic):

- Common CMSSW_5_3_5_Dev
- Generic hit reconstruction
- LA correction from mp1296

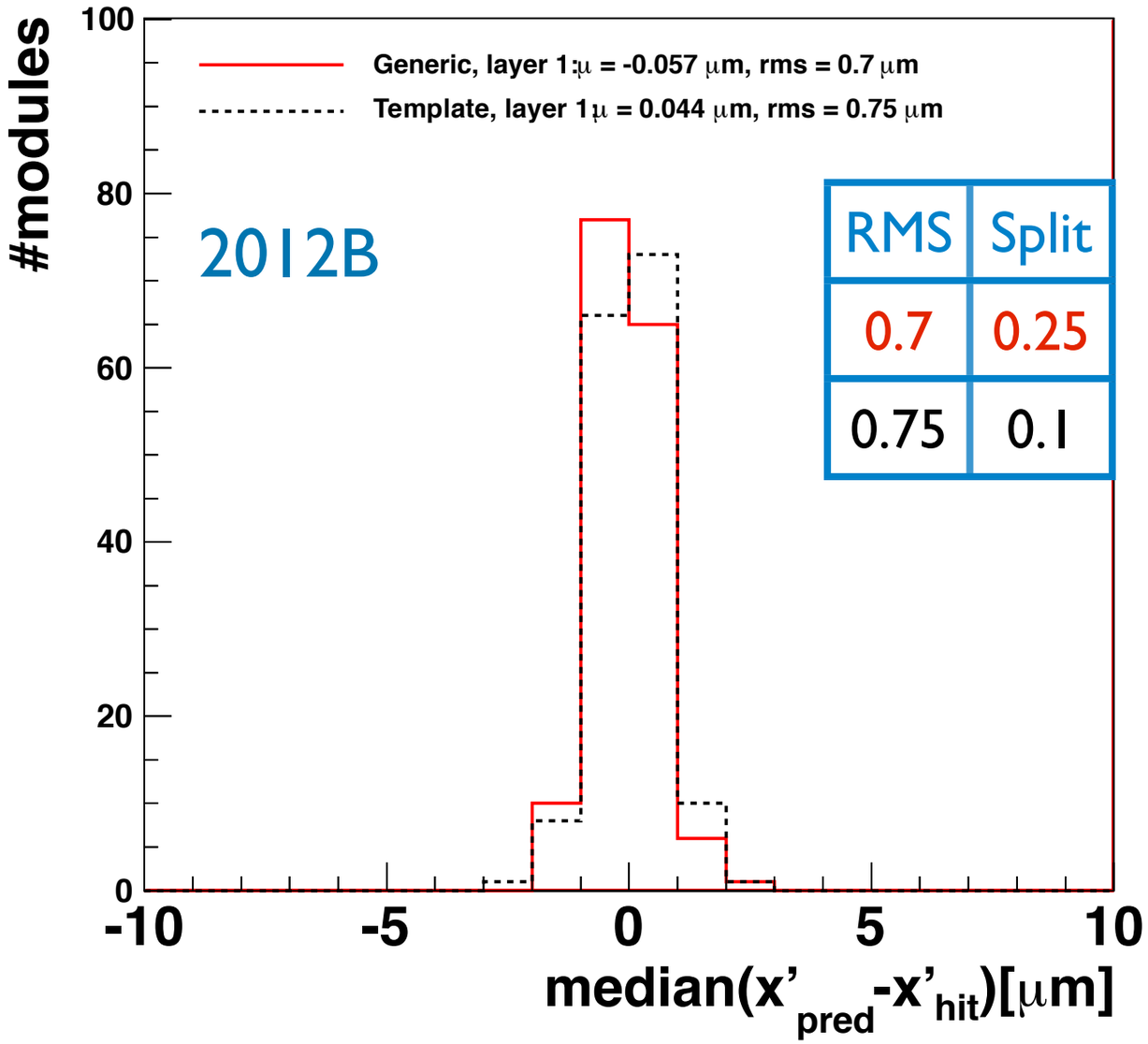
mp1312 (Template):

- Patched common CMSSW_5_3_5_Dev
- Template hit reconstruction
- LA correction from mp1312

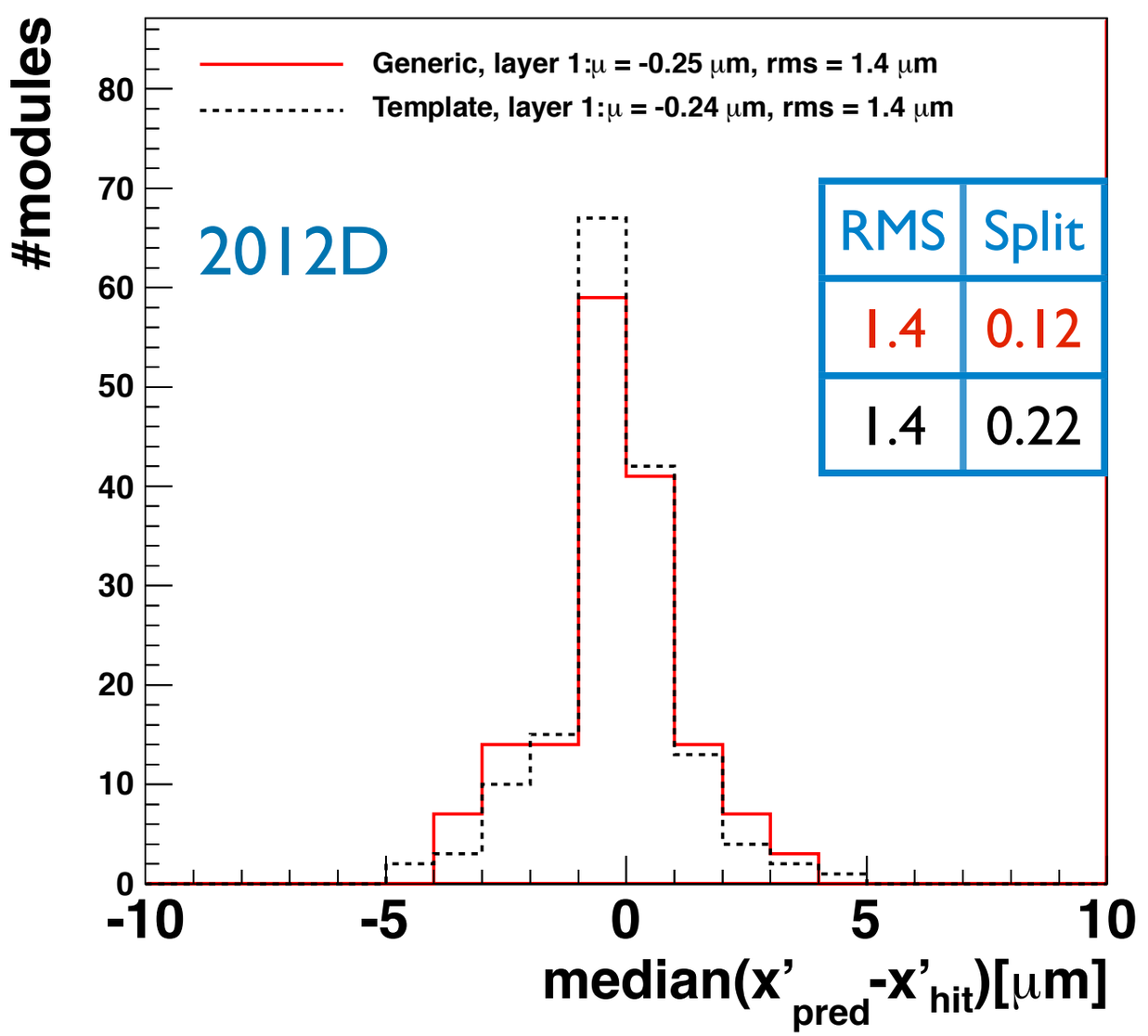
All other conditions are the same.

Validation of LA calibration (Layer 1)

Distribution of the median of the residuals in BPIX



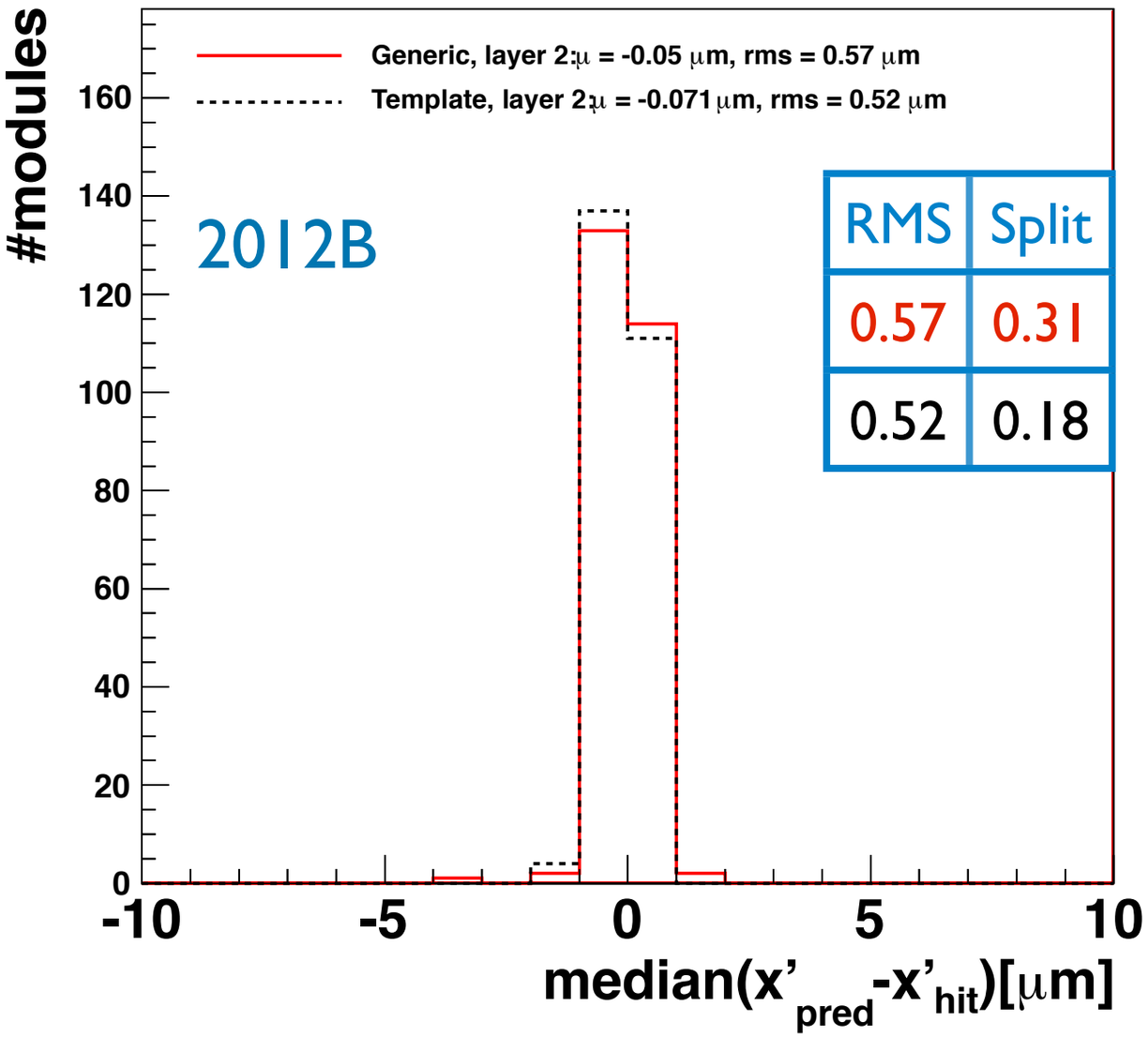
Distribution of the median of the residuals in BPIX



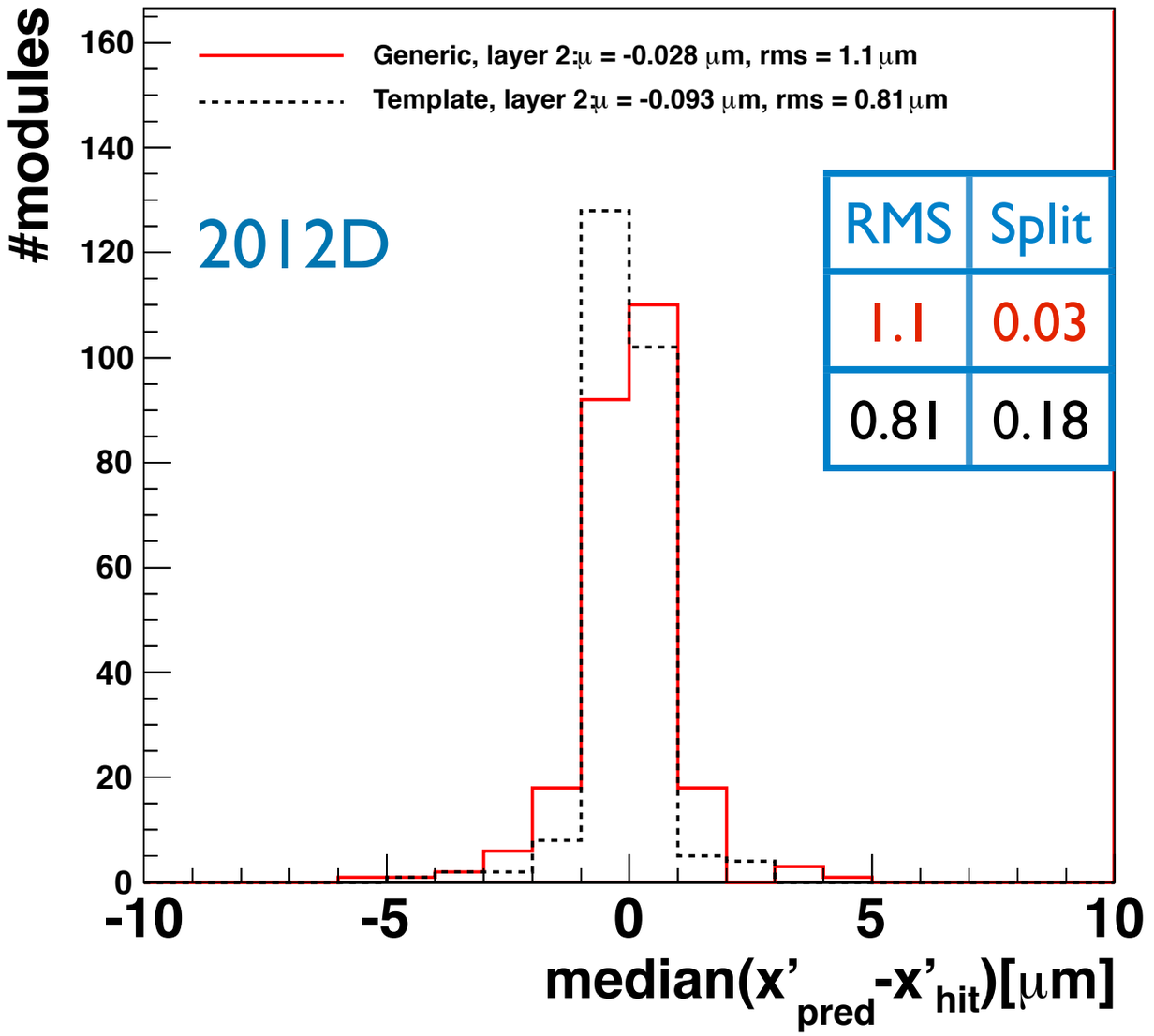
Generic
Pixel template

Validation of LA calibration (Layer 2)

Distribution of the median of the residuals in BPIX



Distribution of the median of the residuals in BPIX

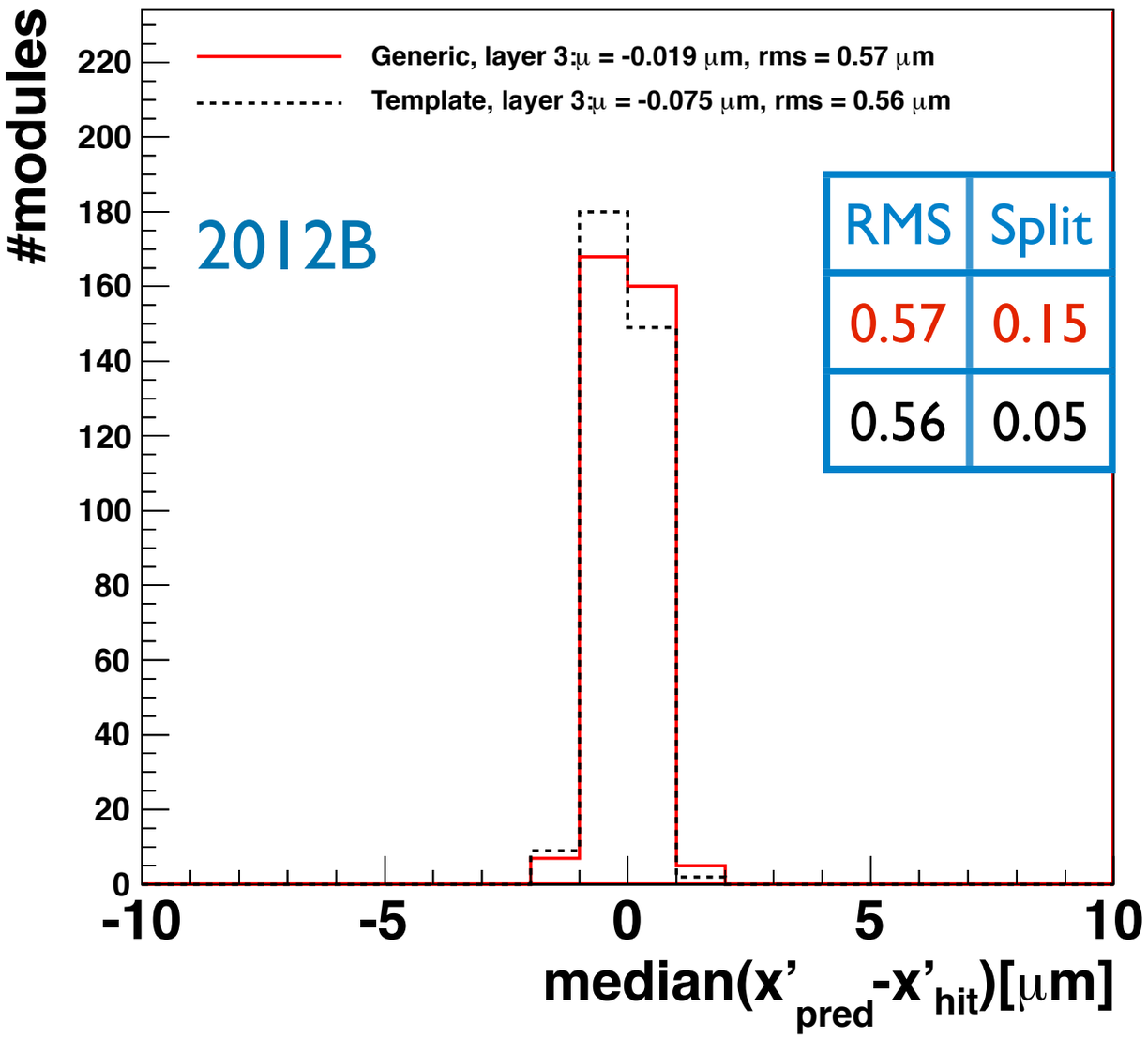


Generic

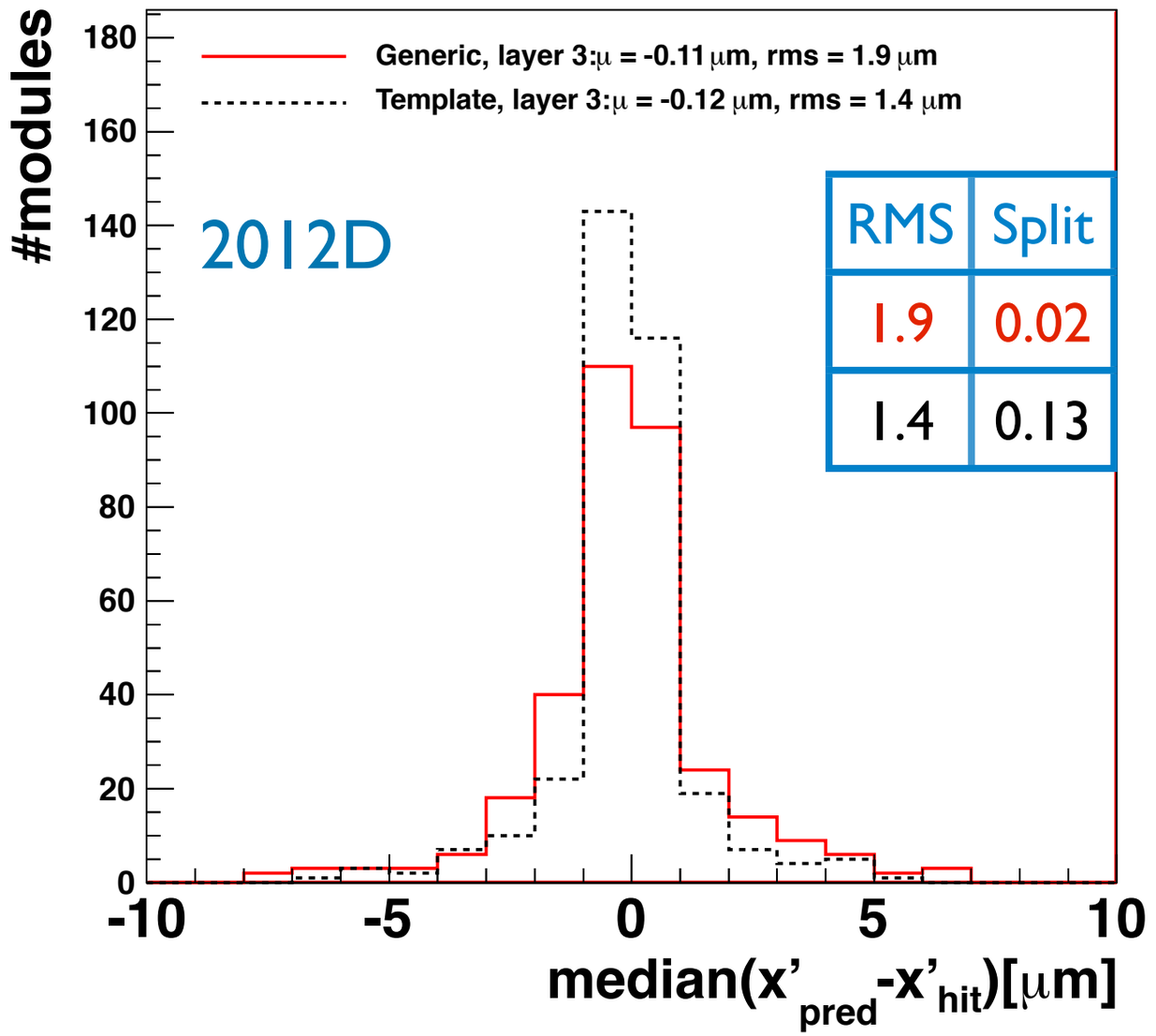
Pixel template

Validation of LA calibration (Layer 3)

Distribution of the median of the residuals in BPIX



Distribution of the median of the residuals in BPIX



Generic
Pixel template

Conclusions

- Code from pixel group works.
- Custom LA correction can calibrated and applied using pixel template hit reconstruction.
- Using pixel templates with LA calibration slightly improves alignment precision.